R E P O R T R E S U M E S

ED 014 551 VT 001 920

DETERMINATION OF THE EDUCATIONAL NEEDS OF AGRICULTURAL ENGINEERING TECHNICIANS IN OHIO, A DIGEST OF A PH.D. DISSERTATION. RESEARCH SERIES IN AGRICULTURAL EDUCATION.

BY- HALTERMAN, JERRY J. BENDER, RALPH E.
OHIO STATE UNIV., COLUMBUS, COLL. OF AG. HOME EC.

PUB DATE JUN 65

EDRS PRICE MF-$0.50 HC-$3.36 82P.

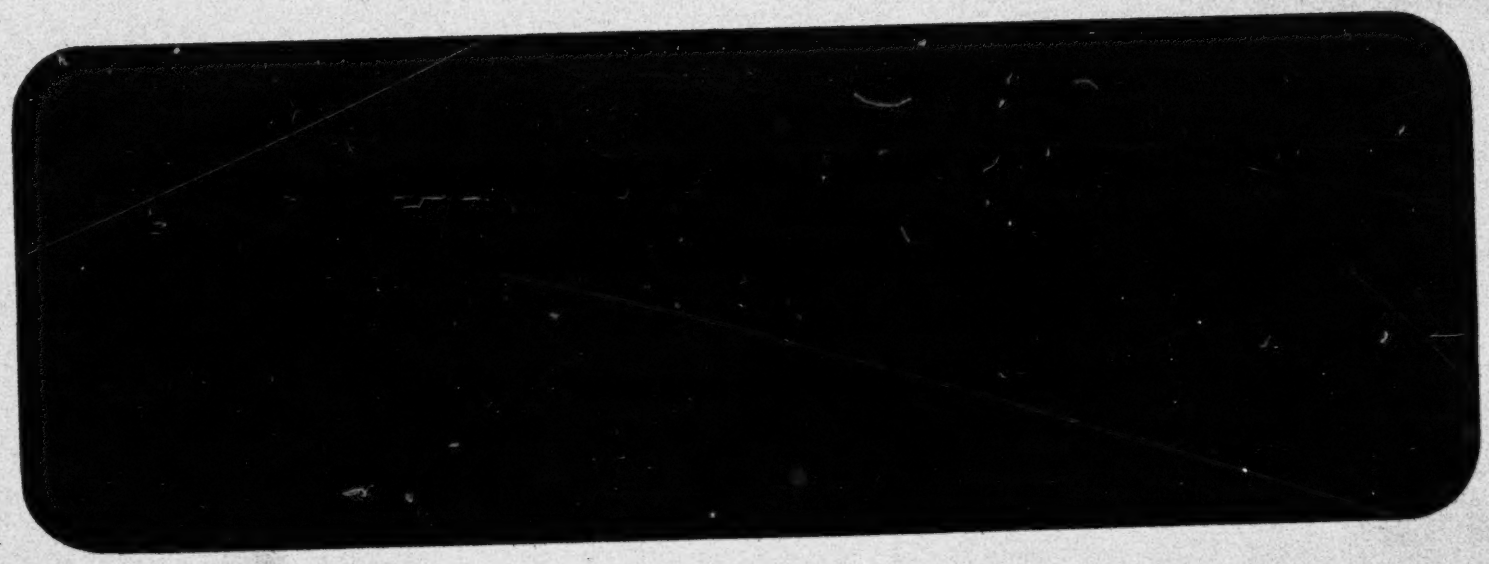
DESCRIPTORS- *EDUCATIONAL NEEDS, *AGRICULTURAL TECHNICIANS, *CURRICULUM DEVELOPMENT, *OCCUPATIONAL SURVEYS, CURRICULUM, *AGRICULTURAL EDUCATION, EMPLOYMENT OPPORTUNITIES, EMPLOYERS, AGRICULTURAL PRODUCTION, AGRICULTURAL ENGINEERING, TECHNICAL EDUCATION, OFF FARM AGRICULTURAL OCCUPATIONS, BIBLIOGRAPHIES, JOB ANALYSIS, GENERAL EDUCATION, INDIVIDUAL CHARACTERISTICS, OHIO,

THIS STUDY WAS DESIGNED TO DEVELOP CURRICULUMS NEEDED IN TRAINING PROGRAMS FOR AGRICULTURAL ENGINEERING TECHNICIANS IN OHIO. A QUESTIONNAIRE TO INVENTORY THE LABOR FORCE WAS ADMINISTERED TO INDIVIDUALS, FIRMS, BUSINESSES, AND AGENCIES EMPLOYING PERSONS IN AREAS REQUIRING AGRICULTURAL ENGINEERING AND FARM MECHANICS. ANOTHER TO COLLECT INFORMATION USEFUL IN DEVELOPING CURRICULUMS WAS ADMINISTERED TO TECHNICIANS. A JURY OF 12 EXPERTS FROM PROFESSIONAL EDUCATION AND AGRICULTURAL INDUSTRY AND ENGINEERING HELPED VALIDATE THE EDUCATIONAL NEEDS OF THE TECHNICIANS. SOME CHARACTERISTICS OF THE LABOR FORCE WERE -- (1) MOST FIRMS AND BUSINESSES WERE MULTIPURPOSE AND ENGAGED IN SEVERAL MAJOR BUSINESS ACTIVITIES, (2) TECHNICIANS WERE EMPLOYED BY 40 PERCENT OF THE TRACTOR AND MACHINERY DEALERS, AND BY ONE-THIRD OF THE FIRMS IN THE AREA OF SOIL AND WATER CONSERVATION, (3) 1,460 PERSONS WERE EMPLOYED FULL-TIME BY 35 PERCENT OF THE FIRMS RESPONDING, AND THE OVERALL RATIO OF TECHNICIANS TO PROFESSIONAL PERSONNEL WAS 0.64 TO 1, AND (4) A 69 PERCENT INCREASE IN LABOR PLACEMENT FOR TECHNICIANS WAS ANTICIPATED BY 1969. ACTIVITIES ENGAGED IN BY TECHNICIANS WERE GIVING LEADERSHIP AND DIRECTION TO OTHERS, MAKING VERBAL OR WRITTEN ACCOUNTING, AND OFFERING ADVICE AND EXPERTNESS. COMMUNICATION SKILLS, APPLIED ARITHMETIC, ELEMENTARY MECHANICS, PERSONNEL MANAGEMENT, AND PSYCHOLOGY WERE CONSIDERED IMPORTANT NEEDED GENERAL EDUCATION SUBJECT AREAS. ONE RECOMMENDATION WAS THAT PROGRAMS FOR PREPARING TECHNICIANS BE DEVELOPED TO PREPARE BOTH "AGRICULTURAL TECHNICIANS-ENGINEERING" AND "AGRICULTURAL TECHNICIANS-MECHANIZED AGRICULTURE." A SUGGESTED CURRICULUM FOR TRAINING AGRICULTURAL ENGINEERING TECHNICIANS, SELECTED TABLES FROM THE STUDY, AND AN EXTENSIVE BIBLIOGRAPHY ARE INCLUDED. (WB)

ED0145551

RESEARCH SERIES IN AGRICULTURAL EDUCATION

A Research Report of a Graduate Study



Issued by
The Department of Agricultural Education
College of Agriculture and Home Economics
The Ohio State University
Columbus, Ohio 43210

July, 1965

VT 01920

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL OFFICE OF EDUCATION POSITION OR POLICY.

RESEARCH SERIES IN AGRICULTURAL EDUCATION

A Digest of a Ph.D. Dissertation

DETERMINATION OF THE EDUCATIONAL NEEDS OF AGRICULTURAL ENGINEERING TECHNICIANS IN OHIO

Jerry J. Halterman and Ralph E. Bender

Issued by

The Department of Agricultural Education

College of Agriculture and Home Economics

The Ohio State University

Columbus, Ohio 43210

June 1965

TABLE OF CONTENTS

Page

DETERMINATION OF THE EDUCATIONAL NEEDS OF AGRICULTURAL ENGINEERING TECHNICIANS IN OHIO

SUMMARY OF THE STUDY 1
Need for the Study. 1
The Purpose of the Study 2
Objectives of the Study 2
Methodology Used and Source of Data 3
The Questionnaires 5
Advisory Committee 5
Jury Members. 5
Summary of Findings. 6
Characteristics of the Agricultural Engineering and Mechanics Labor Force 6
The Educational Needs of Agricultural Engineering Technicians. 9
Activities Engaged in on the Job 9
General Education Subject Matter Areas. 9
Special Education (Technical) Subject Matter Areas. . . . 10
Agricultural Production Subject Matter Areas. 10
Allocation of the Training Period 11
The Extent Which Employee Problems are a Problem of the Firm. 11
Level of Qualification Found in Highly Skilled Workers. . 11
Participation of Private Firms in Public Vocational and Technical Education Programs 12
Traits of Character and Personal Attributes of Workers . 12
The Background of Technical Workers. 12
Technical Education and the Preparation of Agricultural Technicians 13
Conclusions. 15
Recommendations 18
Recommendations for further Study 20

APPENDIX A - Suggested Curriculum for Training Agricultural Engineering Technicians 24

APPENDIX B - Selected Tables from Dissertation. 41

BIBLIOGRAPHY. 73

DETERMINATION OF THE EDUCATIONAL NEEDS OF AGRICULTURAL ENGINEERING TECHNICIANS IN OHIO

Summary of the Study

Need for the study

In line with the increasing complexity of industrial materials, processes and products, and the rapid expansion of technology, particularly in the field of agricultural engineering, there has been a growing recognition of and emphasis on the need for trained workers with a relatively high level of technical knowledge and skill. While the persons presently employed in technical occupations have acquired their knowledge and skills in many different ways, there is an increasing demand to provide technician training in the public schools, particularly on the post-high school level. The need for this study developed out of consideration given to the following points regarding such training programs in Ohio.

1. The same range in levels of occupational preparation is needed for the agricultural segment as for the other sections of the national manpower force.

2. There is an apparent need for the development of programs and the establishment of institutions essential to preparatory programs for training agricultural engineering technicians.

3. No previous studies have been conducted in Ohio dealing with the development of training programs for agricultural engineering technicians.

4. Employers prefer workers who enter the labor market to be older, to have a higher level of native ability, and possess a greater degree of occupational preparation.

5. Public educational programs are not available in Ohio for the preparation of technical workers in the field of agricultural engineering below the baccalaureate level.

6. Public officials, industrial and educational leaders, and the general public need to be apprised of the changes which have recently occurred in the make-up of the agricultural manpower force in Ohio.

The purpose of the study

The major purpose of this study was to develop the curriculums needed in technical training programs for the qualification of agricultural engineering technicians in Ohio.

Objectives of the study

A number of specific objectives having to do with persons employed by agricultural engineering and mechanics agencies and firms in Ohio were identified to guide the direction of this study:

1. Determine the make-up of the manpower force according to the level of occupational preparation required of the workers.

2. Determine the number of workers presently engaged at different levels of occupational preparation.

3. Discover the number of additional job positions anticipated at each occupational level this year (1964) and in 1969.

4. Ascertain the entry salary range for workers at each level.

5. Determine the number of workers at each occupational level who work in each of the major areas of agricultural engineering and farm mechanics.

6. Secure information essential to the classification of agricultural engineering technicians according to the kinds of activities they engage in on the job.

7. Determine the competencies essential to successful job performance by agricultural engineering technicians.

8. Review the literature pertinent to technical education and study various technical education programs.

9. Formulate recommendations, based upon this study, for the development of suggested curriculums for use in post-high school technical training programs to qualify agricultural engineering technicians in Ohio.

Methodology used and source of data

The universe of this study was the individiduals, firms, businesses, and agencies in the State of Ohio who employ persons to engage in occupational endeavor which requires understandings, skills, and abilities in the areas of agricultural engineering and farm mechanics. An attempt was made to include those engaged in each of the agricultural areas of power and machinery, buildings and rural housing, materials-handling and processing, electrification, and soil and water management and use.

The study was primarily designed to determine the educational needs of agricultural engineering technicians but information regarding the make-up of the entire manpower force in agricultural engineering and farm mechanics was also desired. Accordingly, two questionnaires were utilized. The first questionnaire was used to inventory the labor force in question and also to identify workers engaged in technical level work. The second instrument was designed to elicit information essential to the development of curriculums for training agricultural engineering technicians.

Respondents to the first questionnaire included persons who were primarily in ownership and managerial positions. Persons responding to the second questionnaire included technicians who had been recommended by employers on the first questionnaire, employers having a close association with technical workers, and well-known men of the field selected as jury members.

The questionnaires.--The first questionnaire was used to ascertain the general make-up of the work force engaged in agricultural engineering and mechanics endeavor. Information was sought regarding the number of workers employed at present, the number of placement opportunities anticipated in 1964 and in 1969, the approximate entry salary, typical job titles, the necessity of prior farm production training to job placement, and the kinds of activities engaged in on the job. This information was desired for workers in each of the classifications which had been made according to their level-of-occupational preparation--professional, managerial, technical, skilled, semiskilled, and unskilled. Provision was made for employers to recommend one of their employees, who was

considered to be a technician, to the investigator for inclusion in the second part of the survey.

The second questionnaire was designed primarily to secure information useful in the development of curriculums. An occupational analysis was made on the basis of (1) the kinds of activities technicians engage in on the job, and (2) the extent selected subject matter areas contribute to the acquisition of knowledge and the development of understandings, skills, and abilities essential to the satisfactory preparation of highly skilled workers. Subject matter areas in three general academic areas were rated: (1) general education, (2) special education (area of agricultural engineering and mechanics), and (3) related education (agricultural production area).

Advisory committee.--A special advisory committee composed of representatives from agricultural industry and education was formed to render service as requested. A number of meetings were held throughout an eight month period and many helpful suggestions were received from the group. The committee was especially helpful in the development of the questionnaires.

Jury members.--A jury of twelve experts was selected from professional education, agricultural industry and agricultural engineering. Use was made of this jury to help validate the educational needs of agricultural engineering technicians.

Summary of Findings

Following are the major findings from this study. They include determinations made from study in two general areas: (1) from an analysis of data obtained from employers, technical workers, and jury members which were concerned with the make-up of the agricultural engineering and mechanics manpower force in Ohio and the educational needs of workers in that force who are engaged in technical level work; and (2) listing has been made of salient findings revealed from a review of related literature and from the study of various technical education programs.

Characteristics of the agricultural engineering and mechanics labor force

1. Many agricultural engineering and mechanics firms, businesses and agencies are multipurpose and engage in several major business activities. The most predominant ones engaged in are retailing and servicing.

2. Owners and owner-managers accounted for over three-fourths of the persons responding to the first questionnaire which was mailed to the selected firms and agencies. This suggests active management by a high percentage of the owners.

3. Approximately 40 per cent of the tractor and farm machinery dealers in Ohio have technicians in their employ and one-third of the firms engaged in the area of soil and water conservation and use employ this kind of worker.

4. Approximately 1460 persons were employed full-time by the 35 per cent of the agricultural engineering and mechanics firms of Ohio who responded to the survey. The number of persons engaged in work at the various occupational levels were: professional, seventy six; managerial, one hundred sixty three; technical, one hundred fifty three; skilled, five hundred seventy five; semiskilled, three hundred eighty five; and unskilled, one hundred nine.

5. The overall ratio of technicians to professional personnel was found to be .64 to 1.

6. Placement opportunities anticipated by employers this year, 1964, and in 1969, for technicians reflect an optimism for growth and expansion. A 39 per cent (60 job positions) increase is anticipated this year and a 69 per cent (106 job positions) increase is expected in 1969. Full-time placement opportunities anticipated for workers prepared at occupational levels other than technical were, for 1964 and 1969, respectively: professional, 16 and 33; managerial, 29 and 41; skilled, 132 and 120; semiskilled, 69 and 96; and unskilled, 31 and 45.

7. Entry salaries for workers in agricultural engineering and mechanics firms compare favorably with competitive fields. The mean annual entry salary of technicians in this study was estimated to be $6,168 in 1963. By comparison, the average starting salary of graduates of post-secondary technical education programs in 1962 was $4,935.

8. Ninety-seven per cent of the persons responding to the first questionnaire used in this study indicated prior farm production training to be either a desirable or necessary requisite to job placement in the field

of agricultural engineering and mechanics for workers classified at the skilled level or above.

9. Forty-eight per cent of all workers in the field of agriculture engineering and mechanics spend a predominate part of their time in the area of agricultural power and machinery while one-third of the workers spend a major part of their time in the area of soil and water conservation and use. Approximately 3 per cent of the workers spend a greater part of their time in the area of agricultural electrification.

10. Of all technicians identified in this study, over one-half of them (54.5 per cent) spend a predominate part of their time in the area of agricultural power and machinery whereas approximately one-fourth of them (26.0 per cent) spend most of their time in the area of soil and water conservation and use. Nearly one out of every twelve (8.5 per cent) technical workers spends a predominate part of his time in the area of agricultural electrification.

11. Technicians, who need a wide variety of technical abilities, are employed in rural firms having relatively few employees whereas technicians, possessing a higher degree of technical preparation in a more limited field of engineering, are employed in firms of large scope.

12. Titles given or assigned to workers engaged in technical level endeavor in the field of agricultural engineering and mechanics generally are indicative of the level of their occupational preparation. The titles "shop foreman" and "service manager" which were found most often used are illustrative of this use of terms.

The educational needs of agricultural engineering technicians

Activities engaged in on the job. --There were considerable differences in the extent which technical workers engage in various groups of activities among workers in the same area of agricultural engineering as well as among workers in different areas. Three groups of activities were engaged in regularly (rated 2.50 or above on an extent of engagement scale) by technical workers from three general areas of agricultural engineering and mechanics. These three groups of activities were: (1) give leadership and direction to others--manage, supervise, direct, oversee, govern, program; (2) make a verbal or written accounting to others--relate, report, notify, tell, account, inform, apprise, advise; and (3) offer advice and expertness to others--advise, counsel, recommend, suggest, advocate, instruct, and prescribe.

General education subject matter areas. --Difference in the extent which technical workers engage in various groups of activities were also reflected in the levels of importance which general education subject matter areas were perceived by technicians, employers, and jury members. However, a core of general education subject matter areas common to technical workers in different areas of agricultural engineering and mechanics was determined. The subject matter areas included in this core were: communication skills--speech, English composition, and reading; applied arithmetic; elementary mechanics; technical drawing; personnel management; electricity, magnetism, and electronics (basic theory); and psychology. These subject matter areas were all considered

to be important (rated 3.00 or above) to the satisfactory preparation of technicians for work in their respective areas.

Four general education subject matter areas were evaluated by the respondents to warrant a mean rating of 2.00 or lower (indicating of some importance or less) on an importance scale. These areas were differential calculus, general biology, general botany, and general zoology.

Special education (technical) subject matter areas. --There were very few special education subject matter areas evaluated important enough by respondents from all three areas of agricultural engineering to suggest the possibility of a common core of subject matter areas for training technicians for work in these different areas. Four entries in this section were rated 3.00 (important) or above. These four were basic agricultural mechanics, safety, materials-handling, and occupational experience.

Within each area of engineering, there was a high level of agreement among respondent groups as to the level of importance of subject matter areas to the satisfactory preparation of technicians to work within that area. Respondents from the area of agricultural power and machinery rated seventeen of twenty-eight subject matter areas 3.00 (important) or above whereas those from the areas of soil and water conservation and use and agricultural electrification rated seven and six subject matter areas in a like manner respectively.

Agricultural production subject matter areas. --A rather large proportion (12 of 19) of agricultural production subject matter areas were evaluated by the respondents to warrant a mean rating of 2.00 (indicating

of some importance) or above. In contrast, however, there were no subject matter areas rated by the respondents from the three agricultural engineering areas to warrant a mean rating of 3.00 (important) or above.

Allocation of the training period. --The composite means (per cent) of the proportion of a two-year technical training program which should be allocated to selected areas of education as evaluated by technicians, employers, and jury members were as follows: agricultural engineering and mechanics, 36 per cent; general education, 20.42 per cent; occupational experience,. 16.10 per cent; business and management, 15.85 per cent; and production agriculture, 11.72 per cent.

The extent which employee problems are a problem of the firm. --Selected employee problems were rated by employers according to the extent which they are a problem of the firm. The four most serious employee problems which were evaluated by the respondents sufficient to warrant a mean rating of 1.95 (somewhat of a problem) or above on an extent of problem scale all are concerned with training of workers. Qualified workers not available (mean score 2.43) was the most serious problem indicated.

Level of qualification found in highly skilled workers. --Responses of employers, indicating the initial level of qualification found in most of the highly skilled workers as rated on a qualification scale, reveal most employers feel that workers they hire are not adequately qualified in a single one of the nine areas of education selected for study.

Participation of private firms in public vocational and technical education programs. --Forty-four per cent of the employers responding to the survey indicated their firms could and would participate in a placement-for-experience training program in cooperation with a technical school. Twenty-two per cent of the employers indicated personnel would be released to attend classes at school.

Traits of character and personal attributes of workers. --Nearly one-half (48.1 per cent) of the responding employers indicated that desirable and essential traits of character and personal attributes should be the bi-products of a well-balanced, two-year post-high school training program and schools should certify only those students demonstrating minimum qualifications. Approximately three-eighths (37.8 per cent) of the employers indicated a considerable amount of teaching and learning is possible in regards to these things at the post-secondary school level and additional courses should be organized for instruction in such matters. A small percentage (10.3) indicated these qualities and attributes result from complex interactions of many forces in a person's life and the post-secondary school can have little influence in the development of most of them.

The background of technical workers. --Technical workers in the field of agricultural engineering and mechanics had been working in the kind of work they were then engaged in for a mean number of 12.2 years; they had completed a mean number of 13.0 years of school; over two-thirds of them (70.0 per cent) had attended technical, vocational, trade or commercial schools; and over one-half have had previous experience in farming. Nearly

one-third (30.0 per cent) of the technical workers in this field had been prepared for their present work in ways other than formal schooling.

Technical education and the preparation of agricultural technicians

1. Under the stimulus of technological advancement and specialization of services, the occupational structure of the nation's manpower force has undergone extensive change in recent years. Emerging from this change is the demand for a new kind of worker, one who occupies a position on a level-of-occupational-preparation continuum between the positions occupied by professional and skilled workers. This technical worker, called a technician, engages primarily in occupational endeavors in support of or under the supervision of professional personnel and frequently performs tasks that would otherwise be done by professional workers. Technicians are characterized and distinguished by their distinctive abilities, level of occupational competence, and specialized training.

2. Technical education characteristically is post-high school, terminal, occupation centered, less than baccalaureate degree level, specific preparation for employment, oriented toward math and science, and two years in length. Emphasis in technical education is upon technical and cognitive skill in contrast to manipulative skill and upon skill and ability to make practical applications of theoretical knowledge in performing specific tasks in a specialized field. Analysis is made of occupations to determine needs and job analysis is the basis of curriculum development. Preparation is made for occupational proficiency in families or clusters of jobs. A proper

balance of general education, technical education, and related education subjects is maintained.

3. Technical training institutions offer programs which are unique in form and content. These programs serve a function not commensurate with either professional education or vocational training. General abilities needed by prospective technicians to pursue a course of study in these institutions include facility with mathematics, facility to apply physical science principles, ability to understand materials and processes commonly used in technology, knowledge of the field of specialization, and ability to communicate, interpret, analyze, and transmit facts and ideas.

4. Few technical programs exist in the United States which have been developed specifically for preparing agricultural technicians. Most of the agricultural technicians currently being trained are in two year technical programs found in four year agricultural colleges. The technical institutes and the junior colleges are two types of institutions in which training programs for agricultural technicians are rapidly being developed. In addition, Federal and State agencies have made considerable progress in developing classification standards and job descriptions of technical workers in some agricultural fields. In Ohio, one agricultural technical training center has recently been established in which one technical curriculum in agri-business is offered.

The need for agricultural technicians has been confirmed by results of a number of studies recently conducted at the state level in many states. The following definition of an agricultural technician was found

to be acceptable to leading vocational and technical education leaders from forty states:

> An agricultural technician is a worker located in the job classification structure, in his work performance, and in his educational attainment between the skilled worker and the professional. He possesses the skill and ability, working independently or with minimal supervision from a professional, to analyze and interpret information, diagnose problems, make decisions, and make practical applications of theoretical knowledge in performing specific tasks in a specialized field in the production, processing, distribution, or marketing of goods and services in agriculture. He must exercise cognitive skills primarily, but, also, must be able to supervise and perform manipulative skills.

Conclusions

The following conclusions were drawn by the investigator, based on his interpretation of the data and information presented in this study.

1. Technological advancements in the field of agricultural engineering and mechanics have resulted in demands for workers at all levels of occupational endeavor to be more highly qualified. The need is particularly manifest for workers at the technical level.

2. The availability of additional qualified workers and the adequate education of present employees constitutes the major problems of employers.

3. There is need in the agricultural engineering and mechanics labor force for additional workers from all the levels of occupational preparation. The need to increase the ratio of technical to professional personnel is especially demonstrated.

4. Technical occupations in the field of agricultural engineering and mechanics form a continuum from narrow scope, limited level to broad

scope and high level and educational institutions interested in preparing technical workers for this field should consider developing training programs designed to serve the manpower needs of workers throughout this wide range.

5. Although technical workers in the field of agricultural engineering and mechanics have been prepared for their jobs in various ways, it can be concluded that formal, pre-service and full-and part-time extension technical training programs conducted at the post-secondary school level in technical institute type settings are essential to meet current and anticipated needs.

6. Technical workers can be clustered into groups according to a common core of knowledge, skill, and ability needed in job performance. Curriculums, which have as their objective the preparation of persons for a cluster of closely related occupations rather than a single technical occupation, can be based upon the activities engaged in by technicians and on the extent various subject matters contribute to the preparation of workers to engage in technical level endeavor.

7. Objectives of programs for training agricultural engineering technicians should lead to curriculums that are primarily occupation-centered, planned toward occupational competence of the graduate and prepare the student for immediate productive employment. The curriculum pattern should include basic and applied science and mathematics, a high proportion of applied technology, and general education.

8. Increased emphasis should be given to the development and establishment of vocational and technical training programs at the post-secondary school level and particular attention should be given to the

proper qualification of persons to engage in technical level work. A need exists in Ohio for a state-wide master plan of education that will provide for instruction needed to qualify persons for employment in technical occupations in the field of agricultural engineering and mechanics.

9. As workers in the general field of engineering, the following is concluded regarding agricultural engineering technicians: they apply some of the principles, methods, and techniques of a limited range of engineering; the activities they engage in require a practical knowledge of construction, application, properties, operation, and limitations of engineering systems, processes, structures, machinery, devices, and materials; and the work they do requires, as applicable, related manual craft, instrumental, mathematical, and graphic skills.

10. Agricultural production subject matter areas are perceived as being not as important to the qualification of technical workers in agricultural engineering as are technical and general education subject matter areas.

11. There is a need for representatives of agricultural industry and education to work together in order to maximize efficiencies and effectiveness in the use of manpower and material resources. Private firms have indicated a willingness to assume an active role in the task of educating technical workers in the field of agricultural engineering and mechanics.

12. Technicians, employers, and jury members within each general area of agricultural engineering perceive, to a relatively high degree of congruency, the educational needs of technical workers in that area.

Recommendations

The following recommendations, based on the information gathered and ideas growing out of this study, are judgments of the investigator.

It is recommended that:

1. A comprehensive master plan should be developed in Ohio for a state-wide vocational-technical education program at the post-high school level.

2. The master plan should: (1) provide for the immediate implementation of an educational program designed to prepare technical workers, instructors, supervisors, and administrators; (2) reflect policies regarding technical education in agriculture in terms of what the public interest is in technical education, who will be served, and how the needs will be met; and (3) set forth the responsibilities and roles of individuals, groups, and agencies who have a part in technical education.

3. As a part of the state-wide development of technical education programs, an appropriate educational program should be established to meet the educational needs of technical workers for work in the field of agricultural engineering and mechanics through:

   a. Pre-service programs to adequately prepare persons for technical occupations through pre-employment instruction.

   b. In-service programs to improve the knowledge and skill of employed technical workers so they will be better qualified for their present jobs or qualify for higher technical jobs.

   c. Through extension service programs to enable other employed persons to qualify for technical level occupations.

4. Programs for preparing agricultural engineering technicians at two levels should be developed.

a. To prepare "agricultural technicians-engineering" for technological endeavors which require skills, abilities and understandings in considerable depth and over a rather limited field of engineering. Curriculums for training several kinds of technicians in this category should be considered including technical specialities in agricultural hydraulics and pneumatics, agricultural engines and mechanical power transmission, engine auxillary systems, agricultural tractors and mobile power units, agricultural field machinery, agricultural materials-handling and farm processing, soil and water conservation and use, agricultural electrification, and agricultural buildings and rural housing.

b. To prepare "agricultural technicians-mechanized agriculture" for technical work in job positions which require understandings, skills and abilities to work over a considerable range in the field of agricultural engineering and mechanics. Curriculums for preparing technicians in the following options should be developed: agricultural power and machinery; soil and water conservation and use; agricultural materials-handling, farm processing and rural electrification; and agricultural buildings and rural housing.

5. The data and information as well as the suggested curriculums presented in this study should be used as a basis for developing instructional programs for training agricultural engineering technicians in Ohio.

6. Consideration should be given to the development of pre-technical curriculums at the high school level for students interested in pursuing technical training.

7. Personnel and resources should be allocated for use to develop and procure instructional materials needed in technical education programs.

8. School administrators, teachers, legislators, industrial and labor leaders, and others interested in vocational and technical education in Ohio should be apprised of the results of this study.

Recommendations for Further Study

The writer is cognizant that this has been a study into an area about which little is known, into one in which little research has been done, and into one in which there is much newness and that this effort represents but the first of many needed to assemble facts important to the progress of technical education in agriculture. A number of areas need further research. Some of these which the writer is aware of include:

1. To study the need for continuing and extension instruction for those who are already employed in agricultural engineering and mechanical endeavor or those who can advance to technician jobs as a result of technical training.

2. To establish job and position classification standards for various agricultural engineering technicians. The following factors need be

determined for each technical specialty: general characteristics, work situations, operating schedules, guidelines, decisions, contacts, commitments, training, and knowledge, skills and abilities required.

3. To identify the educational needs for workers in the agricultural engineering and mechanics labor force whose positions require other than technical level preparation.

4. To study procedures and techniques by which a more efficient and effective development of human and material resources can be realized by education and agricultural industries working together in the interest of technical education.

5. To develop an overall state plan of public agricultural engineering education to articulate, coordinate, and correlate the efforts of the several institutions and agencies engaged in this field in order to assure maximum efficiency and effectiveness.

6. To study how technical education in agriculture can achieve the status and prestige it needs to perform its proper and vital role in a technological society.

7. To develop new programs for teacher preparation in order to assure quality technical education programs in agricultural engineering.

8. To examine the role of the secondary school vocational program as it should contribute to post-high school technical training.

9. To study how the term "technician" can be defined so that it will receive acceptance and be used appropriately to connote the level of preparation associated with this segment of the manpower force; how

the other so-called technical jobs of narrower scope than those now called technical should be labeled or to propose a new terminology appropriate to workers of all levels of preparation.

10. To study the need for accrediting agricultural engineering technician training programs and to develop suggested procedures for assuring that appropriate high standards will be achieved by institutions offering programs.

11. To determine the need for consultative and specialist services in technical education programs.

APPENDIX A

Suggested Curriculum for Training Agricultural Engineering Technicians

Suggested Curriculums for Training Agricultural Engineering Technicians

The analysis of the data concerning educational needs of technical workers and study of the make-up of the manpower force provides important information upon which to base the development of suggested curriculums for training agricultural engineering technicians. Information presented in these two chapters is concerned with a number of factors important to the construction of curriculums for technical programs--worker activity analysis, subject matter area training needs, occupational survey, anticipated personnel needed and the amount of support employers will give to the training program. It should be pointed out, however, that while this information is most important in curriculum construction, other factors should be considered in a final determination. Objectives of the school, the institutional program, the facilities available, the size and qualification of the teaching staff, trends in industry and financial resources are some of the other determinants to be considered.

Since certain of these factors are beyond the scope of this study, the curriculums developed herein can only <u>suggest</u> those areas of information which should be covered to give students a fund of scientific knowledge which will enable them to perform at a level of competency in entry and continuing positions in agricultural engineering endeavor which will be expected of them upon completion of their studies. These guides should not be imposed upon a given local program in total but rather used as a guide in developing a program which is best suited for a given situation with

all factors being considered. This guide indicates the scope or breadth of concepts to be introduced and a suggested sequence into which these concepts can be arranged.

Technician training programs needed

It is considered by the author that the data of this study suggest that two kinds of technicians are needed in the agricultural engineering and mechanics labor force in Ohio.

1. Agricultural technician-engineering. Semiprofessional workers are needed in direct support of engineers and professional workers who are engaged in research, development, and design activities. Technicians at this level conduct experiments or tests; set up, calibrate and operate instruments; and make calculations. They assist in developing and testing experimental equipment and models, do drafting and frequently assume responsibilities for certain aspects of design work under the direction of engineers. Engineering technicians are highly qualified in a relatively wide scope of technical endeavor. Example of such workers include: technical specialists in agricultural hydraulics; technical specialists in agricultural field machinery; and technical specialists in agricultural power.

Curriculums for training several kinds of agricultural technicians-engineering are considered necessary. The various technical specialties for whom a curriculum is suggested include:

a. Agricultural Hydraulics and Pneumatics

b. Engines and Mechanical Power Transmission

c. Engine and Auxillary Systems

d. Agricultural Tractors and Mobile Power Units

e. Agricultural Field Machinery

f. Agricultural Materials-Handling and Farm Processing

g. Soil and Water Conservation and Use

h. Agricultural Electrification

i. Agricultural Buildings and Rural Housing

Technical workers at this level engage in work which calls for frequent application of mathematical and scientific principles. They must be able to apply these principles and their technical knowledge to a fairly broad field of engineering-related problems. Thus, these workers can be characterized as being field-oriented.

2. Agricultural technician-mechanized agriculture. Highly skilled technicians are needed in engineering occupations in agriculture in which an extensive knowledge of math, science, and engineering in depth is not needed. Technicians at this level use more craft and manipulative skills than does the engineering technician but cognitive know-why and know-how is still the characteristic attribute of this worker. Since this technicians work is usually connected with a specific job, the training can be said to be job-oriented.

Some technical occupations in this category are limited in scope and level. Other of these occupations deal in a large number of different skills and knowledge (scope) but do not require depth of knowledge (level). Jobs in these occupations are not far from the craft worker but are differentiated by the necessity for the technician to apply some science and engineering knowledge.

Curriculums for preparing several kinds of agricultural technicians-mechanized agriculture are considered important. These technical specialties include those in the areas of:

a. Agricultural Power and Machinery

b. Soil and Water Conservation and Use

c. Agricultural Materials Handling, Farm Processing and Rural Electrification

d. Agricultural Building and Rural Housing

Agricultural technician-engineering curriculums

Common core courses. -- An analysis of the educational needs of technical workers engaged in various occupational endeavors in the field of agricultural engineering and mechanics suggests a core of knowledge, skills, and abilities common to these workers could be achieved through a series of courses. These courses are those which are suggested from the data obtained in Chapter V and have to do primarily with mathematics, science, general education, and supporting technical subjects. The following core of courses is proposed for all prospective agricultural technicians-engineering regardless of the technical option elected. The semester system has been elected.

AGRICULTURAL ENGINEERING TECHNOLOGY

Common Core Courses, Agricultural Technician-Engineering

Semester	Course	Units	Hours/week Lecture	Hours/week Laboratory
I	Technical Math I	3	3	-
	Technical Math II	1	1	-
	Technical Physics I	4	3	3
	English I	3	3	-
	Technical Drawing I	1	-	2
II	Technical Math III	3	3	-
	Technical Physics II	4	3	3
	English II	3	3	-
	Technical Drawing II	1	-	2
III	Technical Math IV	3	3	-
	Engineering Laboratory I	3	1	6
	Social Science I	3	3	-
IV	Psychology and Human Relations I	3	3	-
	Personnel Management I	3	3	-

The investigator acknowledges that the determination of course content cannot properly be accomplished within the framework of this study, however, suggestion is made as to some of the areas which might be considered in each of the above courses.

1. Technical Math I (3 Units)

   a. Applied Arithmetic--Measurements and computations of agricultural engineering problems using arithmetic techniques.

   b. Algebra--The use of letters, signs of operation and symbols in treating relations and properties of numbers.

2. Technical Math II (1 Unit)

   a. Slide Rule--Use of the slide rule to solve problems commonly encountered in science and engineering.

3. Technical Math III (3 Units)

   a. Geometry--A study of the relations, properties, and measurements of surfaces, lines and angles.

4. Technical Math IV (3 Units)

   a. Algebra--Simultaneous equations, determinants, quadratics, variations, progressions, logarithmic and exponential functions, and binomial theorem.

5. Technical Math V (3 Units)

   a. Analytic Geometry, Differential Calculus, and Integral Calculus--A one-semester familiarization course built around industrial and engineering problems.

6. Technical Math VI (3 Units)

   a. Electronic Computing Methods--Number systems and their applications to electronic and transistor circuits and specialized math of computers.

7. Technical Physics I (3 Units)

   a. Precision measurement--A study of methods, units, and devices used in scientific measurement.

   b. Matter-Properties, structure, states, and behavior of matter and relationships between matter and energy.

c. Elementary Mechanics--A study of energy force, work, power, friction, and mechanical systems.

d. Hydraulics and hydrostatics--Basic study of fluids at rest, in motion, under confinement, and under pressure.

e. Heat--The concept of heat and its measurement, the effects of temperature and applications to engineering in agriculture.

8. Technical Physics II (3 Units)

a. Magnetism, Electricity, andElectronics--A study of fundamental principles, systems, circuits, equipment and devices.

b. Sound and Light--Principles and fundamentals with emphasis upon agricultural applications.

9. Technical Drawing I (1 Unit)

a. Drafting--Basic drafting techniques, orthographic projection and isometric drawing, diagrams, maps, outlines and graphs. Use of engineering handbooks and standards.

10. Technical Drawing II (1 Unit)

a. Drafting--Intermediate and advanced orthographic projection, vector graphics, sketching, and sectional views.

11. English I

a. Communications--A study to enhance the student's skill in reading, writing, listening, and speaking. Topics for student oral and written reports are chosen from material discussed in their technical courses. Expository writing stressed.

12. English II

    a. Communications--Continuation of English I with technical reporting and public speaking emphasized.

13. Social Science I

    a. American Institutions--The effect of social, economic, and political institutions upon the individual as a citizen and as a worker.

14. Engineering Laboratory

    a. Materials and Processes--A familiarization study of processes and materials used in engineering.

15. Psychology and Human Relations

    a. Behavior--Principles of human behavior and personality development and adjustment. Practical applications of the principles guiding human behavior stressed.

    b. Relations--Emphasis upon work situations, relationships, leadership and supervision.

16. Safety

Although "safety" is not designated as a special subject matter area in the outline of courses, it is an indispensable part of each learning experience. Safety is considered to be more of a "philosophy," for it is directly related to the manner in which a person performs, functions or exposes himself to possible injury and the attitude he has toward the objects or materials with which he works. Proper safety will grow out of desirable personal values, attitudes, and procedures in the use of materials or objects.

In addition to the core of courses proposed for all prospective engineering technicians, additional courses are required for each technical option elected. Suggested courses for each of the nine options are proposed.

Option--Agricultural Hydraulics and Pneumatics

Semester	Course	Units	Hours/week Lecture	Laboratory
I	Agricultural Hydraulics I	4	2	6
	Tractors I	3	1	6
II	Agricultural Hydraulics II	4	2	6
	Agricultural Equipment I	3	1	6
III	Agricultural Hydraulics III	4	2	6
	Agricultural Field Machinery I	3	1	6
	Agronomy and Field Crops I	3	2	3
IV	Agricultural Hydraulics IV	4	2	6
	Agricultural Pneumatics I	4	2	6
	Soil Science I	3	2	3

Option--Farm Engines and Mechanical Power Transmission

Semester	Course	Units	Hours/week Lecture	Laboratory
I	Agricultural Engines I	4	2	6
	Power Transmission I	3	1	6
II	Agricultural Engines II	4	2	6
	Power Transmission II	3	1	6
III	Agricultural Engines III	4	2	6
	Agricultural Equipment I	3	1	6
	Agronomy and Field Crops I	3	2	6
IV	Agricultural Engines IV	4	2	6
	Agricultural Field Machinery I	4	2	6
	Tractors I	3	2	3

Option--Engine Auxillary Systems

Semester	Course	Units	Hours/week Lecture	Laboratory
I	Fuels and Fuel Systems and Carburetion	3	2	3
	Ignition and Ignition Systems	3	2	3
II	Lubrication and Lubrication Systems	3	2	3
	Cooling and Cooling Systems	3	2	3
III	Electric Generators, Alternators	4	2	6
	Electric Starters	3	2	3
	Voltage Regulators	3	2	3
IV	Electrical Instrumentation I	4	2	6
	Agricultural Engines I	4	2	6
	Tractors I	3	2	3

Option--Tractors and Mobile Power Units

Semester	Course	Units	Hours/week Lecture	Laboratory
I	Tractors I	4	2	6
	Agricultural Hydraulics I	3	1	6
II	Tractors II	4	2	6
	Agricultural Field Machinery I	3	1	6
III	Tractors III	4	2	6
	Agronomy and Field Crops I	3	2	3
	Agricultural Engines I	3	1	6
IV	Mobile Agricultural Power Units I	4	2	6
	Soil Science I	3	1	6
	Mechanical Power Transmission I	3	1	6
	Machinery and Equipment Management I	2	2	-

Option--Agricultural Field Machinery

Semester	Course	Units	Hours/week Lecture	Laboratory
I	Field Machinery I	4	2	6
	Agricultural Hydraulics I	3	1	6
II	Field Machinery II	4	2	6
	Tractors I	3	1	6
III	Field Machinery III	4	2	6
	Agricultural Engines I	3	1	6
	Soil Science I	3	2	3
IV	Field Machinery IV	4	2	6
	Agronomy and Field Crops I	3	2	3
	Mechanical Power Transmission I	3	1	6
	Equipment and Machinery Management I	2	2	-

Option--Materials-Handling and Processing

Semester	Course	Units	Hours/week Lecture	Laboratory
I	Materials-Handling I	4	2	6
	Agricultural Electrification I	3	1	6
II	Materials-Handling II	4	2	6
	Mechanical Power Transmission I	3	1	6
III	Agricultural Processing I	4	2	6
	Agricultural Buildings and Housing I	3	1	6
	Agronomy and Field Crops I	3	2	3
IV	Agricultural Processing II	4	2	6
	Animal Husbandry and Dairying I	3	2	3
	Agricultural Equipment I	3	1	6
	Food Technology I	2	1	3

Option--Agricultural Electrification

Semester	Course	Units	Hours/week Lecture	Laboratory
I	Agricultural Electrification I	4	2	6
	Agricultural Buildings and Housing I	3	1	6
II	Agricultural Electrification II	4	2	6
	Agricultural Materials-Handling I	3	1	6
III	Agricultural Electronics I	4	2	6
	Agricultural Processing I	3	1	6
	Animal Husbandry and Dairying I	3	2	3
IV	Agricultural Electronics II	4	2	6
	Poultry Production I	3	2	3
	Agricultural Equipment I	3	1	6
	Machinery and Equipment Management I	2	2	-

Option--Agricultural Buildings and Rural Housing

Semester	Course	Units	Hours/week Lecture	Laboratory
I	Agricultural Building and Housing I	4	2	6
	Agricultural Surveying I	3	1	6
II	Agricultural Building and Housing II	4	2	6
	Agricultural Electrification I	3	1	6
III	Agricultural Building and Housing III	4	2	6
	Agricultural Materials-Handling I	3	1	6
	Animal Husbandry and Dairying I	3	2	3
IV	Agricultural Building and Housing IV	4	2	6
	Agricultural Processing I	3	1	6
	Poultry Production I	3	2	3
	Agricultural Drainage I	2	2	-

Option--Soil and Water Conservation and Use

Semester	Course	Units	Hours/week Lecture	Laboratory
I	Drainage and Irrigation I	4	2	6
	Soil Science I	3	1	6
II	Soil and Water Conservation I	4	2	6
	Agricultural Surveying I	3	1	6
III	Soil and Water Conservation II	4	2	6
	Agricultural Machinery and Equipment I	3	1	6
	Agricultural Surveying II	2	1	3
IV	Soil and Water Conservation III	4	2	6
	Tractors I	3	1	6
	Agronomy and Field Crops I	3	2	3
	Machinery and Equipment Management I	2	2	-

Agricultural technician-mechanized agriculture curriculums

Common core courses. --It is proposed that prospective agricultural technicians-mechanized agriculture take the same required core courses for the first two semesters as are suggested for students in the agricultural technician-engineering curriculum. Students pursuing the latter curriculum are expected to continue further in the field of mathematics than the students in the mechanized agriculture curriculum. An additional change proposed for this core of courses other than the deletion of mathematics in the third and fourth semesters is the inclusion of a business course in accounting, servicing, selling, and merchandising. As can be noted, the greatest contrast between the two proposed curriculums for training agricultural engineering technicians at the two different levels is found in the differences

in the breadth and scope of the programs. The curriculum for preparing agricultural technicians-engineering is designed to qualify workers to be able to work in a fairly wide field of engineering endeavor but one which requires considerable depth of preparation. This approach is intended to be field oriented. On the other hand, the curriculum for preparing agricultural technicians-mechanized agriculture is developed to qualify technicians for a much broader area and not in as much depth. This approach is considered to be job oriented.

Suggested courses, in addition to the basic core of courses, for each technical option elected in the curriculums for agricultural technician-mechanized agriculture are listed below.

Option--Agricultural Power and Machinery

Semester	Course	Units	Hours/week Lecture	Laboratory
I	Agricultural Engines I (M)*	3	1	6
	Agricultural Field Machines I (M)	3	1	6
II	Agricultural Engines II (M)	3	1	6
	Agricultural Field Machines II (M)	3	1	6
	Agricultural Materials-Handling I (M)	2	1	3
III	Agricultural Engines III (M)	3	1	6
	Agricultural Field Machines III (M)	3	1	6
	Agricultural Tractors I (M)	2	1	3
	Crop Production I (M)	3	2	3
IV	Agricultural Engines IV (M)	3	1	6
	Agricultural Field Machines IV (M)	3	1	6
	Business Organization and Management I (M)	2	1	3
	Power, Machinery and Equipment Management I (M)	2	2	-

*M denotes course is designed for curriculums developed to prepare agricultural technicians-mechanized agriculture.

Option--Soil and Water Conservation and Use

Semester	Course	Units	Hours/week Lecture	Laboratory
I	Agricultural Surveying I (M)	3	1	6
	Soil Science and Fertilizers I (M)	3	2	3
II	Soil Conservation I (M)	3	1	6
	Plant Science I (M)	3	2	3
	Agricultural Power I (M)	2	1	3
III	Soil Conservation II (M)	3	1	6
	Field Crops and Horticulture I (M)	3	2	3
	Agricultural Field Machinery I (M)	2	1	3
IV	Soil Conservation III (M)	5	2	9
	Pastures and Forage Crops I (M)	3	2	3
	Irrigation and Drainage Equipment I (M)	2	1	3

Option--Agricultural Materials--Handling, Farm Processing and Rural Electrification

Semester	Course	Units	Hours/week Lecture	Laboratory
I	Agricultural Materials-Handling I (M)	3	1	6
	Electrification I (M)	3	2	3
II	Agricultural Materials-Handling II (M)	3	1	6
	Agricultural Processing I (M)	3	2	3
	Agricultural Electrification II (M)	3	1	6
III	Agricultural Engines I (M)	3	1	6
	Agricultural Materials Handling III (M)	3	1	6
	Agricultural Processing II (M)	3	2	3
IV	Agricultural Buildings I (M)	3	1	6
	Agricultural Processing III (M)	3	2	3
	Power, Equipment, and Machinery Management I (M)	2	2	-

Option--Agricultural Buildings and Rural Housing

Semester	Course	Units	Hours/week Lecture	Hours/week Laboratory
I	Agricultural Buildings and Housing I (M)	4	2	6
	Agricultural Electrification I (M)	3	1	6
II	Agricultural Buildings and Housing II (M)	4	2	6
	Agricultural Materials-Handling I (M)	3	1	6
III	Agricultural Buildings and Housing III (M)	3	1	6
	Agricultural Processing I (M)	3	2	3
IV	Agricultural Buildings and Housing IV (M)	3	1	6
	Animal Husbandry and Dairy Production (M)	3	1	6
	Poultry Production (M)	2	1	3

APPENDIX B

Selected Tables from Dissertation

TABLE 1

MAJOR BUSINESS ACTIVITIES OF OHIO AGRICULTURAL ENGINEERING AND MECHANICS BUSINESS FIRMS

Activity	Number[a]	Per Cent of Total[b]
Retailing	158	51.20
Servicing	72	23.30
Manufacturing	20	6.48
Wholesaling	16	5.20
Contracting	15	4.86
Purchasing	11	3.57
Construction	8	2.59
Processing	5	1.62
Other	4	1.29
Total	309	100.11

[a] A number of firms engage in more than one major business activity.

[b] Per cent of total of all activities reported.

TABLE 2

THE NUMBER OF FULL- AND PART-TIME EMPLOYEES ENGAGED IN AGRICULTURAL ENGINEERING AND MECHANICS WORK ACCORDING TO LEVEL OF OCCUPATIONAL PREPARATION

Level of Occupational Preparation	Total Number Employed Last Year (1963)	
	Full-Time	Part-Time
Professional	76	--
Managerial	163	7
Technical	153	3
Skilled	575	20
Semiskilled	385	49
Unskilled	109	27
Total	1461	106

TABLE 3

THE NUMBER OF PLACEMENT OPPORTUNITIES ANTICIPATED IN THE FIELD OF AGRICULTURAL ENGINEERING AND MECHANICS IN 1964 AND 1969 ACCORDING TO THE LEVEL OF OCCUPATIONAL PREPARATION

Level of Occupational Preparation	Number of Placement Opportunities Anticipated			
	1964		1969	
	Full-Time	Part-Time	Full-Time	Part-Time
Professional	16	1	33	--
Managerial	29	2	41	4
Technical	60	4	106	9
Skilled	132	29	120	45
Semiskilled	69	13	96	16
Unskilled	31	--	45	6
Total	337	49	441	80

TABLE 4

THE APPROXIMATE ENTRY SALARY OF WORKERS IN THE FIELD OF AGRICULTURAL ENGINEERING AND MECHANICS IN OHIO ACCORDING TO LEVEL OF OCCUPATIONAL PREPARATION

Level of Occupational Preparation	Approximate Entry Salary per Month Full- Time Mean
Professional	$850
Managerial	574
Technical	514
Skilled	417
Semiskilled	366
Unskilled	294

TABLE 5

EXAMPLES OF JOB TITLES USED IN THE AGRICULTURAL ENGINEERING AND MECHANICS INDUSTRY IN OHIO ACCORDING TO THE LEVEL OF OCCUPATIONAL PREPARATION

Level of Occupational Preparation	Examples of Titles Used	
Professional	1. Engineer	4. Service Manager
	2. Service Engineer	5. Hydraulic Engineer
	3. Sales Engineer	6. Sales Manager
Managerial	1. General Manager	4. Resident Manager
	2. Sales Manager	5. Office Manager
	3. Service Manager	6. Vice President
Technical	1. Service Manager	4. Field Engineer
	2. Parts Manager	5. Sales Representative
	3. Conservation Engineering Technician	6. Head Mechanic
Skilled	1. Machinery Mechanic	4. Serviceman
	2. Tractor Mechanic	5. Machine Operator
	3. Welder	6. Electrician
Semiskilled	1. Mechanic	4. Assembler
	2. Mechanic Helper	5. Machine Helper
	3. Repairman	6. Set-up Man
Unskilled	1. Truckers	4. General Help
	2. Loaders	5. Delivery Men
	3. Mechanic's Assistant	6. Tile Layer

TABLE 6

EMPLOYER REACTION AS TO THE NECESSITY OF FARM PRODUCTION TRAINING PRIOR TO PLACEMENT IN THE FIELD OF AGRICULTURAL ENGINEERING AND MECHANICS ACCORDING TO THE LEVEL OF OCCUPATIONAL PREPARATION

Level of Occupational Preparation	Necessity of Farm Production Training[a]		
	Necessary[b]	Desirable[b]	Not Necessary[b]
Professional	6	--	2
Managerial	32	29	2
Technical	45	33	--
Skilled	56	50	4
Semiskilled	33	49	6
Unskilled	--	14	20

[a] Not all firms responded to this question.

[b] Number of firms indicating level of necessity.

TABLE 7

NUMBER OF WORKERS WHO SPEND A PREDOMINATE PART OF THEIR TIME IN EACH OF THE GENERAL AREAS OF AGRICULTURAL ENGINEERING ACCORDING TO LEVEL OF OCCUPATIONAL PREPARATION (N=1461)

General Area of Agricultural Engineering	Number of Workers by Level of Occupational Preparation							
	Professional	Managerial	Technical	Skilled	Semi-Skilled	Un-Skilled	Total	Per Cent
Agricultural Power	17	52	54	203	67	20	413	28.2
Agricultural Machinery	13	37	30	109	84	24	297	20.3
Agricultural Buildings and Rural Housing	4	1	7	4	9	1	26	1.8
Agricultural Electrification	--	4	13	15	9	0	41	2.8
Soil and Water Management and Use	31	35	40	174	177	35	492	33.6
Agricultural Construction and Maintenance	--	4	6	29	3	1	43	2.9
Agricultural Materials-Handling and Processing	--	4	4	4	25	5	42	2.9
Number Not Reported	--	--	--	--	--	--	107	7.3

TABLE 8/

MEAN SCORES OF EMPLOYER, TECHNICIAN, AND JURY MEMBER RESPONSES TO THE EXTENT WHICH TECHNICAL WORKERS ENGAGE IN GROUPS OF ACTIVITIES IN THE AREA OF AGRICULTURAL POWER AND MACHINERY

Activity Group	Technician Mean[a]	Employer Mean[a]	Jury Member Mean[a]	Chi Square Score
1. GIVE LEADERSHIP AND DIRECTION TO OTHERS--Manage, supervise, direct, oversee, govern, program.	2.83	2.91	2.62	6.113
2. PUBLICLY SHOW AND ENCOURAGE THE ADOPTION AND USE OF MECHANICAL DEVICES AND ENGINEERING SERVICES--Demonstrate, sell.	2.48	2.36	2.38	2.553
3. USE ENGINEERING PRINCIPLES AND TECHNIQUES TO FORM NEW APPLICATIONS--Invent, plan, design, originate, devise, create.	2.13	1.76	2.00	12.479*
4. COMMUNICATE ENGINEERING IDEAS AND INFORMATION TO OTHERS GRAPHICALLY--Illustrate, diagram, design, layout, blueprint.	2.20	1.76	2.62	20.656*
5. MAKE A VERBAL OR WRITTEN ACCOUNTING TO OTHERS--Relate, report, notify, tell, account, inform, apprise, advise.	2.76	2.49	2.88	8.655

TABLE 8 (cont'd.)

Activity Group	Technician Mean[a]	Employer Mean[a]	Jury Member Mean[a]	Chi Square Score
6. PUT THE PARTS OF SOMETHING TOGETHER OR SET UP FOR USE OR SERVICE--Construct, build, assemble, modify, install.	2.70	2.56	2.12	7.584
7. MAINTAIN AND KEEP IN OPERATIONAL REPAIR--Adjust, service, maintain, minor repairs and replacement of parts.	2.83	2.56	2.38	7.365
8. FIND OUT WHY THERE HAS BEEN SUCCESS, FAILURE OR TROUBLE--Inspect, examine, analyze, investigate, inquire, test.	2.67	2.69	2.50	2. 1117
9. FIX AND MAKE OPERATIONAL AGAIN--Major overhaul, repair and replacement of major parts.	2.65	2.59	2.25	2.993
10. SEE IF SOMETHING WORKS, TRY OUT, ASCERTAIN BY EXPERIMENT, COMPARE FOR PROOF--Test, prove, give a trial, verify.	2.43	2.40	2.62	7.509

/Similar data are available for "Soil and Water Conservation and Use" and "Agricultural Electrification" in the dissertation.

TABLE 8 (cont'd)

Activity Group	Technician Mean[a]	Employer Mean[a]	Jury Member Mean[a]	Chi Square Score
11. OPERATE AND/OR MAKE PROPER APPLICATION AND USE OF ON THE JOB DESIGNED FOR--Operate, adjust, manipulate, calibrate, regulate.	2.76	2.62	2.75	6.239
12. OFFER ADVICE AND EXPERTNESS TO OTHERS--Advise, counsel, recommend, suggest, advocate, instruct, prescribe.	2.92	2.78	2.88	3.146
13. EVALUATE RESULTS, DETERMINE THE VALUE OF AND COME TO A CONCLUSION--Evaluate, assess, appraise, rate, estimate, select, judge, value.	2.48	2.32	2.75	5.923

*Exceeds the chi square value at the 5 per cent level of significance.

[a]Scale:

Regularly	Occasionally	Rarely
(3)	(2)	(1)

TABLE 9 /

COMPOSITE MEAN SCORES AND RANKING OF RESPONSES TO THE EXTENT WHICH WORKERS ENGAGE IN ACTIVITIES IN THE AREA OF AGRICULTURAL POWER AND MACHINERY

Activity Group	Composite Mean
1. GIVE LEADERSHIP AND DIRECTION TO OTHERS--Manage, supervise, direct, oversee, govern, program.	2.86
2. OFFER ADVICE AND EXPERTNESS TO OTHERS--Advise, counsel, recommend, suggest, advocate, instruct, prescribe.	2.83
3. OPERATE AND/OR MAKE PROPER APPLICATION AND USE OF ON THE JOB DESIGNED FOR--Operate, adjust, manipulate, calibrate, control, adapt, hitch, regulate.	2.68
4. FIND OUT WHY THERE HAS BEEN SUCCESS, FAILURE OR TROUBLE--Inspect, examine, analyze, investigate, inquire, review, test.	2.67
5. MAINTAIN AND KEEP IN OPERATIONAL REPAIR--Adjust, service, maintain, minor repair and replacement of parts.	2.64
6. MAKE A VERBAL OR WRITTEN ACCOUNTING TO OTHERS--Relate, report, notify, tell, account, inform, apprise, advise.	2.60
7. PUT THE PARTS OF SOMETHING TOGETHER OR SET UP FOR USE OR SERVICE--Construct, build, assemble, modify, install.	2.58
8. FIX AND MAKE OPERATIONAL AGAIN--Major overhaul, repair and replacement of major parts.	2.58
9. SEE IF SOMETHING WORKS, TRY OUT, ASCERTAIN BY EXPERIMENT, COMPARE FOR PROOF--Test, prove, give a trial, verify.	2.42

TABLE 9 (cont'd)

Activity Group	Composite Mean
10. EVALUATE RESULTS, DETERMINE THE VALUE OF AND COME TO A CONCLUSION--Evaluate, assess, appraise, rate, estimate, value, judge, select.	2.40
11. PUBLICLY SHOW AND ENCOURAGE THE ADOPTION AND USE OF MECHANICAL DEVICES AND ENGINEERING SERVICES--Demonstrate, promote, sell, exhibit, display, market.	2.40
12. COMMUNICATE ENGINEERING IDEAS AND INFORMATION TO OTHERS GRAPHICALLY--Illustrate, diagram, design, layout, blueprint.	1.96
13. USE ENGINEERING PRINCIPLES AND TECHNIQUES TO FORM NEW APPLICATIONS--Invent, plan, design, originate, devise, create.	1.90

/Similar data are available for "Soil and Water Conservation and Use" and "Agricultural Electrification" in the dissertation.

TABLE 10/

MEAN SCORES OF EMPLOYER, TECHNICIAN, AND JURY MEMBER RESPONSES TO THE IMPORTANCE OF GENERAL EDUCATION SUBJECT MATTER AREAS TO THE SATISFACTORY PREPARATION OF TECHNICIANS FOR WORK IN THE AREA OF AGRICULTURAL POWER AND MACHINERY

Subject Matter Area	Technician Mean[a]	Employer Mean[a]	Jury Member Mean[a]	Chi Square Score
1. COMMUNICATION SKILLS: SPEECH	3.72	3.18	3.88	16.169*
2. COMMUNICATION SKILLS: ENGLISH COMPOSITION	2.91	2.50	3.38	15.431*
3. COMMUNICATION SKILLS: READING	3.74	3.65	3.88	4.283
4. APPLIED ARITHMETIC	3.37	2.98	3.88	12.775*
5. ELEMENTARY ALGEBRA	2.28	1.84	2.50	20.869*
6. ADVANCED ALGEBRA	1.65	1.36	1.38	10.861
7. PLANE GEOMETRY	2.13	1.71	2.12	12.416
8. TRIGONOMETRY	1.76	1.28	2.00	25.177*
9. CALCULUS, DIFFERENTIAL	1.46	1.26	1.00	8.625
10. CHEMISTRY, INORGANIC	2.52	1.76	2.38	26.151*
11. CHEMISTRY, ORGANIC	2.72	1.95	2.25	23.905*

TABLE 10 (cont'd)

Subject Matter Area	Technician Mean[a]	Employer Mean[a]	Jury Member Mean[a]	Chi Square Score
12. ELEMENTARY MECHANICS	3.76	3.38	3.88	12.385
13. ELECTRICITY, MAGNETISM AND ELECTRONICS (BASIC THEORY)	3.46	3.08	3.38	8.005
14. HYDRAULICS (BASIC THEORY)	3.85	3.68	3.62	6.284
15. PROPERTIES OF MATERIALS	2.78	2.28	3.12	18.939*
16. TECHNICAL DRAWINGS	2.83	2.55	3.25	13.001*
17. BIOLOGY, GENERAL	1.59	1.34	1.62	11.397
18. BOTANY, GENERAL	1.67	1.39	1.25	7.628
19. ZOOLOGY, GENERAL	1.46	1.35	1.25	2.748
20. TYPING, PERSONAL	2.15	1.98	2.38	11.776
21. ACCOUNTING	2.44	2.09	2.00	8.503
22. SALESMANSHIP	3.39	3.16	3.25	6.127
23. ADVERTISING	2.26	2.15	2.88	7.733
24. FINANCE, INSURANCE, TAXATION	2.39	1.91	2.50	11.012

TABLE 10 (cont'd)

Subject Matter Area	Technician Mean[a]	Employer Mean[a]	Jury Member Mean[a]	Chi Square Score
25. PERSONNEL MANAGEMENT	3.48	3.35	3.38	5.573
26. BUSINESS LAW	2.15	1. 84	2.12	5.721
27. PSYCHOLOGY	3.22	2.80	2.62	9.513
28. SOCIOLOGY, INTRODUCTORY	2.11	1.90	2.38	13.084*
29. ECONOMICS - INTRODUCTION TO	2.20	1.99	2.12	7.282

*Exceeds the chi square value at the 5 per cent level of significance.

[a]Scale:

Very Important	Important	Of Some Importance	Unimportant
(4)	(3)	(2)	(1)

/Similar data are available for "Soil and Water Conservation and Use" and "Agricultural Electrification" in the dissertation.

TABLE 11

COMPOSITE MEAN SCORES AND RANKING OF RESPONSES TO THE IMPORTANCE OF GENERAL EDUCATION SUBJECT MATTER AREAS TO THE SATISFACTORY PREPARATION OF TECHNICIANS FOR WORK IN THE AREA OF AGRICULTURAL POWER AND MACHINERY

Subject Matter Area	Composite Mean
1. HYDRAULICS (BASIC THEORY)	3.73
2. COMMUNICATION SKILLS: READING	3.69
3. ELEMENTARY MECHANICS	3.54
4. COMMUNICATION SKILLS: SPEECH	3.40
5. PERSONNEL MANAGEMENT	3.40
6. SALESMANSHIP	3.24
7. ELECTRICITY, MAGNETISM AND ELECTRONICS (BASIC THEORY)	3.22
8. APPLIED ARITHMETIC	3.16
9. PSYCHOLOGY	2.93
10. COMMUNICATION SKILLS: ENGLISH COMPOSITION	2.69
11. TECHNICAL DRAWINGS	2.68
12. PROPERTIES OF MATERIALS	2.50
13. CHEMISTRY, ORGANIC	2.23
14. ADVERTISING	2.23
15. ACCOUNTING	2.20
16. FINANCE, INSURANCE, TAXATION	2.11

TABLE 11 (cont'd)

Subject Matter Area	Composite Mean
17. ECONOMICS - INTRODUCTION TO	2.07
18. TYPING, PERSONAL	2.06
19. CHEMISTRY, INORGANIC	2.06
20. ELEMENTARY ALGEBRA	2.03
21. SOCIOLOGY, INTRODUCTORY	2.00
22. BUSINESS LAW	1.96
23. PLANE GEOMETRY	1.88
24. TRIGONOMETRY	1.48
25. BOTANY, GENERAL	1.48
26. ADVANCED ALGEBRA	1.46
27. BIOLOGY, GENERAL	1.44
28. ZOOLOGY, GENERAL	1.38
29. CALCULUS, DIFFERENTIAL	1.32

/Similar data are available for "Soil and Water Conservation and Use" and "Agricultural Electrification" in the dissertation.

TABLE 12 /

MEAN SCORES OF EMPLOYER, TECHNICIAN, AND JURY MEMBER RESPONSES TO THE IMPORTANCE OF SPECIAL EDUCATION SUBJECT MATTER AREAS TO THE SATISFACTORY PREPARATION OF TECHNICIANS FOR WORK IN THE AREA OF AGRICULTURAL POWER AND MACHINERY

Subject Matter Area	Technician Mean[a]	Employer Mean[a]	Jury Member Mean[a]	Chi Square Score
1. BASIC AGRICULTURAL MECHANICS--Use of common hand and power tools for wood, metal, concrete, paint, and rope work.	3.52	3.31	3.50	9.397
2. WELDING AND SOLDERING--Electric arc, oxy-acetylene, tungsten inert gas welding; heating, brazing, cutting, hard surfacing, and soldering.	3.65	3.49	3.12	13.553*
3. SAFETY--Agricultural accidents associated with engineering and mechanics.	3.76	3.62	3.75	3.771
4. INTERNAL COMBUSTION ENGINES (BASIC THEORY)--Principles of operation, design and construction; maintenance, service, power measurement and testing.	3.83	3.81	3.62	1.577
5. INTERNAL COMBUSTION ENGINES--Complete repair and overhaul, trouble shooting.	3.76	3.74	3.25	6.362

TABLE 12 (cont'd)

Subject Matter Area	Technician Mean[a]	Employer Mean[a]	Jury Member Mean[a]	Chi Square Score
6. ENGINE ELECTRICAL SYSTEMS--Ignition, lighting, generation and starting; servicing, trouble shooting, testing and repairing.	3.74	3.78	3.38	8.051
7. AGRICULTURAL DIESEL ENGINES--Principles, design and construction, operation, servicing, repair and overhaul.	3.87	3.80	3.50	9.659
8. MECHANICAL POWER TRANSMISSION--Principles, systems, design and construction, operating, servicing and repair.	3.61	3.68	3.50	12.307
9. AGRICULTURAL HYDRAULICS--Application, operation, inspection, testing, servicing and repair of circuits and systems.	3.80	3.79	3.50	4.844
10. AGRICULTURAL MACHINERY I--Tillage, seed bed preparation, and planting equipment.	3.57	3.44	3.62	2.699
11. AGRICULTURAL MACHINERY II--Equipment for applying chemicals and fertilizers; for thinning and pruning, and cultivating.	3.26	3.29	3.62	9.121

TABLE 12 (cont'd)

Subject Matter Area	Technician Mean[a]	Employer Mean[a]	Jury Member Mean[a]	Chi Square Score
12. AGRICULTURAL MACHINERY III--Harvesting equipment and machinery.	3.54	3.54	3.62	1.490
13. MACHINERY IV--Industrial equipment; backhoes, loaders, scrapers, diggers, carryalls, etc.	3.13	3.29	3.38	2.561
14. AGRICULTURAL TRACTORS I--Selection, operation, management and use, weight - transfer, hitching, traction, and field testing.	3.59	3.78	3.75	4.526
15. AGRICULTURAL TRACTORS II--Design, construction, overhaul, repair, and shop testing.	3.50	3.70	3.38	10.715
16. POWER, MACHINERY AND EQUIPMENT MANAGEMENT--Selection, determination of costs, efficiencies, combinations, capacities, performance, requirements and measurements.	3.13	3.02	3.62	4.087
17. AGRICULTURAL MACHINERY DESIGN AND CONSTRUCTION--Use of power units and systems in solving agricultural engineering problems.	2.80	2.69	3.12	7.324

TABLE 12 (cont'd)

Subject Matter Area	Technician Mean[a]	Employer Mean[a]	Jury Member Mean[a]	Chi Square Score
18. AGRICULTURAL STRUCTURES DESIGN AND CONSTRUCTION--Principles and methods of construction, requirements of utilities, production equipment, structure, housing, and storage.	2.35	2.21	2.88	10.169
19. STRUCTURAL MATERIALS--Standards, performance, durability, strength, ease of application, grades, costs, etc.	2.35	2.16	3.38	16.725*
20. AGRICULTURAL ELECTRIFICATION--Principles, systems and applications of electrical energy; equipment and devices for manual and automatic control.	2.54	2.40	2.88	9.388
21. AGRICULTURAL MATERIALS--HANDLING--Transportation, pumps, augers, elevators, drags, conveyors, lifts, hoists.	3.04	2.75	3.62	21.509*
22. AGRICULTURAL PROCESSING (FEEDS AND SEEDS)--Equipment for drying, grinding, crushing, mixing, separating, cleaning, metering, ventilating, etc.	2.65	2.56	3.25	5.209

TABLE 12 (cont'd)

Subject Matter Area	Technician Mean[a]	Employer Mean[a]	Jury Member Mean[a]	Chi Square Score
23. AGRICULTURAL PROCESSING (FOODS)--Equipment for heating, freezing, cooling, extracting, standardizing, analyzing, canning, etc.	1.63	1.48	1.62	3.184
24. AGRICULTURAL SURVEYING--Use of surveying instruments and equipment for measurement, layout, and mapping.	1.52	1.32	1.75	12.925*
25. AGRICULTURAL DRAINAGE--Principles, systems, installations, equipment, devices.	1.74	1.45	1.88	10.625
26. IRRIGATION--Land preparation, water distribution systems, water application methods.	1.61	1.41	1.12	6.287
27. SOIL AND WATER CONSERVATION--Soil mapping and control, water supply and control, soil and water reclamation.	2.13	1.70	2.38	17.505*
28. OCCUPATIONAL EXPERIENCE--Placement in industry for job training experience.	3.30	2.71	3.38	15.435*

*Exceeds the chi square value at the 5 per cent level of significance.

[a]Scale:

Very Important	Important	Of Some Importance	Unimportant
(4)	(3)	(2)	(1)

/Similar data are available for "Soil and Water Conservation and Use" and "Agricultural Electrification" in the dissertation.

TABLE 13 /

COMPOSITE MEAN SCORES AND RANKING OF RESPONSES TO THE IMPORTANCE OF SPECIAL EDUCATION SUBJECT MATTER AREAS TO THE SATISFACTORY PREPARATION OF TECHNICIANS FOR WORK IN THE AREA OF AGRICULTURAL POWER AND MACHINERY

	Subject Matter Area	Composite Mean
1.	INTERNAL COMBUSTION ENGINES (BASIC THEORY)	3.81
2.	AGRICULTURAL DIESEL ENGINES	3.81
3.	AGRICULTURAL HYDRAULICS	3.77
4.	ENGINE ELECTRICAL SYSTEMS	3.74
5.	INTERNAL COMBUSTION ENGINES	3.72
6.	AGRICULTURAL TRACTORS I	3.71
7.	SAFETY	3.68
8.	MECHANICAL POWER TRANSMISSION	3.64
9.	AGRICULTURAL TRACTORS II	3.61
10.	AGRICULTURAL MACHINERY III	3.54
11.	WELDING AND SOLDERING	3.52
12.	AGRICULTURAL MACHINERY DESIGN AND CONSTRUCTION	3.50
13.	AGRICULTURAL MACHINERY I	3.50
14.	BASIC AGRICULTURAL MECHANICS	3.40
15.	AGRICULTURAL MACHINERY II	3.29

TABLE 13 (cont'd)

Subject Matter Area	Composite Mean
16. MACHINERY IV	3.25
17. POWER, MACHINERY AND EQUIPMENT MANAGEMENT	3.10
18. OCCUPATIONAL EXPERIENCE	2.96
19. AGRICULTURAL MATERIALS - HANDLING	2.90
20. AGRICULTURAL PROCESSING (FEEDS AND SEEDS)	2.63
21. AGRICULTURAL ELECTRIFICATION	2.48
22. AGRICULTURAL STRUCTURES DESIGN AND CONSTRUCTION	2.30
23. STRUCTURAL MATERIALS	2.30
24. SOIL AND WATER CONSERVATION	1.89
25. AGRICULTURAL DRAINAGE	1.58
26. AGRICULTURAL PROCESSING (FOODS)	1.54
27. IRRIGATION	1.46
28. AGRICULTURAL SURVEYING	1.42

/Similar data are available for "Soil and Water Conservation and Use" and "Agricultural Electrification" in the dissertation.

TABLE 14/

MEAN SCORES OF EMPLOYER, TECHNICIAN, AND JURY MEMBER RESPONSES TO THE IMPORTANCE OF AGRICULTURAL PRODUCTION SUBJECT MATTER AREAS TO THE SATISFACTORY PREPARATION OF TECHNICIANS FOR WORK IN THE AREA OF AGRICULTURAL POWER AND MACHINERY

Subject Matter Area	Technician Mean[a]	Employer Mean[a]	Jury Member Mean[a]
1. VEGETABLE CROP PRODUCTION--Tomatoes, sweet corn, potatoes, lettuce, cantaloupe.	1.85	1.69	2.12
2. FORAGE AND PASTURE CROP PRODUCTION--Alfalfa, clover, grasses.	2.59	2.25	2.75
3. CEREAL CROP PRODUCTION--Corn, wheat, oats.	2.83	2.41	2.88
4. OIL CROP PRODUCTION--Soybeans.	2.46	2.30	2.88
5. SMALL FRUIT PRODUCTION--Strawberries, bushberries, grapes.	1.56	1.36	1.62
6. TREE FRUITS AND NUT PRODUCTION--Apples, peaches, walnuts.	1.63	1.35	1.62
7. TOBACCO PRODUCTION	1.52	1.29	1.50
8. SUGAR CROP PRODUCTION--Sugar beets.	1.59	1.44	1.62
9. GREENHOUSE AND NURSERY CROP PRODUCTION--Flowers, turf, ornamentals, trees, vines, shrubs.	1.70	1.38	1.62

TABLE 14 (cont'd)

Subject Matter Area	Technician Mean[a]	Employer Mean[a]	Jury Member Mean[a]
10. POULTRY PRODUCTION--Chickens and turkeys.	1.80	1.61	2.00
11. LIVESTOCK PRODUCTION--Swine, beef, sheep.	2.28	2.14	2.88
12. DAIRY PRODUCTION--Dairy cattle.	2.44	2.15	2.88
13. AGRICULTURAL ECONOMICS--Agricultural economic concepts, principles, problems, price making, marketing, federal and state programs.	2.24	1.98	2.25
14. AGRICULTURAL MARKETING--Principles, policies, channels, institutions, agencies, cooperatives, marketing orders, variations, integration.	2.13	1.99	2.20
15. AGRICULTURAL ACCOUNTING--Types of records, measures of earnings and efficiency computations.	2.20	1.99	2.25
16. AGRICULTURAL FINANCE--Agencies, policies, credit, procurement, extension and management.	2.35	2.08	2.00

TABLE 14 (cont'd)

Subject Matter Area	Technician Mean[a]	Employer Mean[a]	Jury Member Mean[a]
17. AGRICULTURAL BUSINESS PLANNING--Organization and operation, economic and management principles, farm plan development.	2.22	1.99	2.50
18. FOOD TECHNOLOGY--Microbiology of dairy, fruit, vegetables and meat products; principles, methods and techniques.	1.54	1.44	1.00
19. GENERAL SOIL SCIENCE--Physical and chemical properties, use and management practices.	2.24	1.95	2.75

[a]Scale:

Very Important	Important	Of Some Importance	Unimportant
(4)	(3)	(2)	(1)

/Similar data are available for "Soil and Water Conservation and Use" and "Agricultural Electrification" in the dissertation.

TABLE 15 /

COMPOSITE MEAN SCORES AND RANKINGS OF RESPONSES TO THE IMPORTANCE OF AGRICULTURAL PRODUCTION SUBJECT MATTER AREAS TO THE SATISFACTORY PREPARATION OF TECHNICIANS FOR WORK IN THE AREA OF AGRICULTURAL POWER AND MACHINERY

	Subject Matter Area	Composite Mean
1.	CEREAL CROP PRODUCTION--Corn, wheat, oats.	2.58
2.	FORAGE AND PASTURE CROP PRODUCTION--Alfalfa, clover, grasses.	2.40
3.	OIL CROP PRODUCTION--Soybeans.	2.39
4.	DAIRY PRODUCTION--Dairy cattle.	2.29
5.	LIVESTOCK PRODUCTION--Swine, beef, sheep.	2.23
6.	AGRICULTURAL FINANCE--Agencies, policies, credit, procurement, extension and management.	2.16
7.	AGRICULTURAL BUSINESS PLANNING--Organization and operation, economic and management principles, farm plan development.	2.10
8.	GENERAL SOIL SCIENCE--Physical and chemical properties, use and management practices.	2.10
9.	AGRICULTURAL ACCOUNTING--Types of records, measures of earnings and efficiency computations.	2.08
10.	AGRICULTURAL ECONOMICS--Agricultural economic concepts, principles, problems, price making, marketing, federal and state programs.	2.08
11.	AGRICULTURAL MARKETING--Principles, policies, channels, institutions, agencies, cooperatives, marketing orders, variations, integration.	2.04

TABLE 15 (cont'd)

Subject Matter Area	Composite Mean
12. VEGETABLE CROP PRODUCTION--Tomatoes, sweet corn, potatoes, lettuce, cantaloupe.	1.77
13. POULTRY PRODUCTION--Chickens and turkeys.	1.70
14. SUGAR CROP PRODUCTION--Sugar beets.	1.50
15. GREENHOUSE AND NURSERY CROP PRODUCTION--Flowers, turf, ornamentals, trees, vines, shrubs.	1.50
16. TREE FRUITS AND NUT PRODUCTION--Apples, peaches, walnuts.	1.46
17. SMALL FRUIT PRODUCTION--Strawberries, bush-berries, grapes.	1.45
18. FOOD TECHNOLOGY--Microbiology of dairy, fruit, vegetable and meat products; principles, methods and techniques.	1.45
19. TOBACCO PRODUCTION	1.38

/Similar data are available for "Soil and Water Conservation Use" and "Agricultural Electrification" in the dissertation.

TABLE 16/

MEAN SCORES OF EMPLOYER, TECHNICIAN, AND JURY MEMBER RESPONSES TO THE PERCENTAGE OF THE TRAINING PERIOD WHICH SHOULD BE ALLOCATED TO SELECTED AREAS IN A TRAINING PROGRAM FOR AGRICULTURAL ENGINEERING TECHNICIANS - POWER AND MACHINERY AREA

Area of Education	Technician Mean (per cent)	Employer Mean (per cent)	Jury Member Mean (per cent)	Area Mean (per cent)
1. GENERAL EDUCATION--English and speech; physical, biological and social science; math, etc.	20.20	18.82	14.38	19.00
2. BUSINESS AND MANAGEMENT--Accounting, economics, salesmanship, bookkeeping, management, etc.	17.02	16.56	13.85	16.53
3. AGRICULTURAL ENGINEERING AND MECHANICS--Power and machinery, buildings and housing, electrification, soil and water conservation, materials - handling and processing.	33.02	38.09	38.13	36.25
4. PRODUCTION AGRICULTURE--Livestock, dairy, poultry husbandry; crops, tree and vine production; management, marketing, etc.	11.91	10.52	18.12	11.45
5. OCCUPATIONAL EXPERIENCE--Placement in industry for job training experience.	18.08	16.38	15.48	16.82

/Similar data are available for "Soil and Water Conservation and Use" and "Agricultural Electrification" in the dissertation.

TABLE 17

COMPOSITE MEAN SCORES AND RANKINGS OF RESPONSES TO THE PERCENTAGE OF A TWO-YEAR TECHNICAL TRAINING PROGRAM WHICH SHOULD BE ALLOCATED TO SELECTED AREAS OF EDUCATION

Area of Education	Composite Mean (per cent)
1. AGRICULTURAL ENGINEERING AND MECHANICS--Power and machinery, buildings and housing, electrification, soil and water conservation, materials - handling and processing.	36.00
2. GENERAL EDUCATION--English and speech; physical, biological, and social science; match and etc.	20.42
3. OCCUPATIONAL EXPERIENCE--Placement in industry for job training experience.	16.10
4. BUSINESS AND MANAGEMENT--Accounting, economics, salesmanship, bookkeeping, management, etc.	15.85
5. PRODUCTION AGRICULTURE--Livestock, dairy, poultry husbandry; crops, tree and vine production; management, marketing, etc.	11.72

BIBLIOGRAPHY

BIBLIOGRAPHY

Public Documents

Bishop, C. E., and Tolley, G. S. Manpower in Farming and Related Occupations. A report made for the Panel of Consultants on Vocational Education. Office of Education. Washington: U. S. Government Printing Office, 1963.

Dean, Gerald W., and McCorkle, Chester O. Jr. Projections Relating to California Agriculture in 1975. Bulletin 778 California Agricultural Experiment Station. Berkeley: University of California, 1961.

Emerson, Lynn A. Technical Training in the United States. A report made for the Panel of Consultants on Vocational Education. Office of Education. Washington: U. S. Government Printing Office, 1963.

U. S. Congress. Public Law 85-864, 85th Congress. National Defense Education Act, 1958.

U. S. Congress. Public Law 87-415, 87th Congress. Manpower Development and Training Act of 1962, 1962.

U. S. Civil Service Commission. Forestry Technician Series. GS-462-0, April, 1960.

U. S. Civil Service Commission. Position Classification Standards for Engineering Technician Series. GS-800-TS, 1963.

U. S. Civil Service Commission. Soil Conservation Aid. Announcement No. B-74-3, 1963.

U. S. Civil Service Commission. Surveying Technician Series. GS-817-0, October, 1959.

U. S. Department of Health, Education and Welfare. Area Vocational Education Programs, Administration of Title VIII National Defense Education Act of 1958. P. O. 864, 85th Congress, Misc. No. 3560, Office of Education. Washington: U. S. Government Printing Office, 1958.

U. S. Department of Health, Education, and Welfare. Education for a Changing World of Work. Report of the Panel of Consultants on Vocational Education. Office of Education. Washington: U.S. Government Printing Office, 1963.

U. S. Department of Health, Education, and Welfare. Electrical Technology. A Suggested 2-year Post-High School Curriculum. Office of Education. Washington: U. S. Government Printing Office, 1960.

U. S. Department of Health, Education, and Welfare. Electrical and Electronic Technology. Miscellaneous Bulletin 3570-2. Washington: U. S. Government Printing Office, 1960.

U. S. Department of Health, Education, and Welfare. Mechanical Drafting and Design Technology. Area Vocational Branch, Division of Vocational Education, Office of Education. Washington: U. S. Government Printing Office (not dated).

U. S. Department of Health, Education, and Welfare. Mechanical Technology, Design and Production. Office of Education. Washington: U. S. Government Printing Office, 1962.

U. S. Department of Health, Education,and Welfare. Meeting Manpower Needs for Technicians. Report of a National Conference on Vocational-Technical Education. Office of Education. Washington: U.S. Government Printing Office, 1957.

U. S. Department of Health, Education, and Welfare. Occupational Criteria and Preparatory Curriculum Patterns in Technical Education Programs. Vocational Division Bulletin No. 296, Office of Education. Washington: U. S. Government Printing Office, 1962.

U. S. Department of Health, Education, and Welfare. Organized Occupational Curriculums. Circular No. 568, Office of Education. Washington: U. S. Government Printing Office, 1959.

U. S. Department of Health, Education, and Welfare. Vocational-Technical Education for American Industry. Circular No. 530, Office of Education. Washington: U. S. Government Printing Office, 1958.

U. S. Department of Labor, Bureau of Employment Security. A Comprehensive Study of Technician Jobs Supporting Engineers and Physical Scientist. A Progress Report Prepared for the National Science Foundation and President's Committee on Scientists and Engineers. Washington: U. S. Government Printing Office, January, 1958.

U. S. Department of Labor, Bureau of Labor Statistics. Employment Outlook for Technicians: A Report on Technicians Who Work With Engineers and Physical Scientists. Veterans Administration Pamphlet 22-1. Washington: U. S. Government Printing Office, March, 1958.

U. S. Department of Labor. Manpower, Challenge of the 1960's. Washington: U. S. Government Printing Office, 1961.

U. S. Department of Labor, Bureau of Labor Statistics. Occupational Outlook Handbook. 1963-64 Edition, Bulletin No. 1375. Washington: U. S. Government Printing Office, 1963.

U. S. Department of Labor, Bureau of Labor Statistics. Occupational Outlook Handbook, 1963-64 Edition, Bulletin No. 1875. Washington: U. S. Government Printing Office, 1963.

Articles and Periodicals

Adams, H. P. "Technical-Institute Programs at Degree-granting Institutions," Technical Education News (June, 1951), 2.

Arnold, Walter M. "Meeting Manpower Needs Through Technical Education," American Vocational Journal, XXXVII, No. 9 (December, 1962), 8-11.

Benedict, Harris M. "The Physical Sciences in Agriculture," Stanford Research Institute Journal, IV (Third Quarter, 1960), 79.

Committee on Agricultural Teacher Training, Education, and Research Division, "Agricultural Engineering Phases of Teacher Education in Agriculture," Agricultural Engineering (June, 1960), 382-385.

Karnes, Ray. "Technical Education," Review of Educational Research, XXXII (October, 1962), 423.

Roney, Maurice W. "Trends in Technical Education," School Shop, XXII (March, 1963), 17, 28.

Smith, Marion L. "The Team Scientist, Engineer, and Technician," Mechanical Engineering (March, 1963).

_____. "Agricultural Engineering Phases of Teacher Education," Agricultural Engineering, XXXXI, No. 6 (June, 1960), 382-385.

Reports

A Survey of Technical Occupations in Oregon, A Preliminary Report by the Trade and Industrial Education Service, Salem, Oregon: Sate Division of Vocational Education, March, 1959.

American Society for Engineering Education, Characteristics of Excellence in Engineering Technology Education. Urbana: University of Illinois, 1962.

Blackmon, John H., and Dawson, Cleburn G. Need for Training for Non-Farm Agricultural Occupations. Raleigh: Department of Public Instruction, 1961.

Emerson, Lynn A. Technician Training Beyond the High School. Raleigh: Vocational Materials Laboratory, Division of Vocational Education, North Carolina Department of Public Instruction, 1962.

Flesher, William R., et al. Public Vocational-Technical Education in Oregon. Columbus, Ohio: School Survey Service, 1958.

Halterman, Jerry J. Technicians in Agriculture. Sacramento: California State Department of Education, 1962.

James, Gerald B. "Vocational and Technical Education," Using Current Curriculum Developments. Washington: Association for Supervision and Curriculum Development, National Education Association, 1963.

McLure, John R. Area Vocational Education Programs for "Technicians." Alabama: University of Alabama Bulletin, 1959.

McLure, William P., et al. Vocational and Technical Education in Illinois: Tomorrow's Challenge. Urbana: Bureau of Educational Research, College of Education, University of Illinois, 1960.

Ohio Notebook of Public Post-High School Technical Education Programs, 1963-1964. Columbus: Division of Guidance and Testing, State Department of Education, March, 1964.

Proceedings of the National Seminar on Agricultural Education Sponsored by the National Center for Advanced Study and Research in Agricultural Education, The Ohio State University, Columbus, Ohio, July 20-24, 1964.

Phipps, Lloyd J., et al. Technical Education in and for Rural Areas Preliminary Report No. 1. Urbana, Illinois: University of Illinois, June, 1964.

Reese, Robert M., and Woodin, Ralph J. (ed.) Meeting Ohio's Needs for Vocational and Technical Education. Columbus: Division of Vocational Education, Ohio Department of Education, 1957.

"Report of the Education and Accreditation Committee," Engineers' Council for Professional Development, Thirtieth Annual Report, 1961-1962.

Russell, John Dale. "Meeting Ohio's Needs in Higher Education," A Report of a Prelinary Survey for The Committee on the Expanding Student Population, appointed by the Ohio College Association. Wooster, Ohio: The Ohio College Association, 1956.

Smith, Harold T. Education and Training for the World of Work, A Vocational Education Program for the State of Michigan, Kalamazoo, Michigan: W. E. Upjohn Institute for Employment Research, July, 1963.

State Steering Committee on Vocational Education in the Junior College. "The Development of Technical Education in California," Vocational-Technical Education in California Junior Colleges. Sacramento: California State Department of Education, 1961.

Stewart, Lawrence H., and Workman, Arthur D. Mathematics and Science Competencies for Technicians. Sacramento: California State Department of Education, 1960.

The American Society for Engineering Education, Characteristics of Excellence in Engineering Technology Education. Urbana, Illinois: University of Illinois, 1962.

The Engineering Technician. Urbana: Technical Institute Division, American Society for Engineering Education, University of Illinois, Undated.

Wood, Herbert S. A Study of Technical Education in California. Sacramento: California State Department of Education, 1959.

Unpublished Material

Bodine, Merle W. "The Areas of Training Needs of Highly Skilled Technicians in Twenty-Three Selected Kansas Industries." Unpublished Master's thesis, Kansas State Teachers College, 1954.

Brum, Herbert B. "Opportunities for Agricultural Occupations in Ohio," Ph.D. dissertation study in progress, The Ohio State University, 1963-1964.

Clary, Joseph R. "Guidelines for the Development of Training Programs for Agricultural Technicians." Unpublished Ph.D. dissertation, The Ohio State University, 1964.

Cotrell, Calvin James. "A Study of Factors Essential to Staffing Post-Secondary Technical Education Programs." Unpublished Ph.D. dissertation, The Ohio State University, 1958.

Gates, Newell L. "The Place of the Technical Institute in American Education." Unpublished Ph.D. dissertation, The Ohio State University, 1951.

Phallen, Charles Wellington. "The Technical Institute Movement." Unpublished Ph.D. dissertation, The Ohio State University, 1958.

Schaefer, Carl John. "A Study to Determine a Master Plan for Post-Secondary Vocational-Technical Education for the State of Ohio." Unpublished Ph.D. dissertation, The Ohio State University, 1959.

Sheribini, Ibrahim Abdul-Aziz El. "A Study of the Staffing Problems in Community Colleges and Technical Institutes of the State Universities of New York with Particular Reference to Problems of In-Service Professional Development." Unpublished Ph.D. dissertation, Cornell University, 1959.

Snepp, Neil Owen. "Agricultural Offerings in Community Colleges in the United States." Unpublished Ph.D. dissertation, The Ohio State University, 1963.

Yearbooks

Emerson, Lynn A. "Forecast of Future Trends in Technician Education," Technician Education Yearbook 1963-64. Ann Arbor, Michigan: Prakken Publications, Inc., 1963.

Parkinson, George. "Training Mechanical Technicians at Milwaukee Institute of Technology," Technician Education Yearbook 1963-64. Ann Arbor, Michigan: Prakken Publications, Inc., 1963.

Schaefer, Carl J., and McCord, Robert E. "The Technician: Some Definitions," Technician Education Yearbook, 1963-64. Ann Arbor, Michigan: Prakken Publications, Inc., 1963.

Schuchat, Theodor. "Employed Technicians Today-and in 1970," Technician Education Yearbook 1963-64. Ann Arbor, Michigan: Prakken Publications, Inc., 1963.

Other Sources

Nelson, Richard S. "Meeting Manpower Needs for Technicians." A speech given at the Pacific Regional Conference on Trade and Industrial Education, 1958.

Ohio, Senate Bill 326, 105th General Assembly, Regular Session, 1963-1964.

State University of New York Agricultural and Technical Institute at Farmingdale, Catalog, 1960-1962. Albany: State University of New York, 1960.

State University of New York Agricultural and Technical Institute at Morrisville, Catalog, 1963-1964.